

Application No.: 10/729,322

Docket No.: JCLA12520

AMENDMENTS

Please amend the application as indicated hereafter.

In the Specification:

Please amend the specification in the following paragraphs.

[0006] According to the object(s) mentioned above, the present invention provides a refrigerating device, wherein a compressor, a gas cooler, an expansion mechanism and an evaporator are sequentially connected by using refrigerant pipes. The refrigerating device uses a mixture refrigerant in which a combustible ~~nature~~ hydrocarbon refrigerant and a carbon dioxide refrigerant are mixed. The amount of the carbon dioxide refrigerant in the mixture refrigerant is about 20 to 50 mass %.

[0007] The present invention further provides a refrigerating device, wherein a compressor, a gas cooler, an expansion mechanism and an evaporator are sequentially connected by using refrigerant pipes. The refrigerating device uses a mixture refrigerant in which a combustible ~~nature~~ hydrocarbon refrigerant and a carbon dioxide refrigerant are mixed. A maximum fill amount of the combustible nature refrigerant is 150g.

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[0012] The refrigerant mixture is first described. The refrigerant mixture of used in the refrigerating device of the present invention is a refrigerant that carbon dioxide and at least one kind of combustible nature hydrocarbon refrigerant (other than the carbon dioxide) are mixed.

[0013] Since the carbon dioxide has a low warming coefficient and is nontoxic, the use of which is very superior in environment protection and safety issues. However, the use of only carbon dioxide as the refrigerant cannot achieve a high coefficient of performance (COP, hereinafter). According to the present invention, an amount of the carbon dioxide is set at about 20 to 50 mass %, and the carbon dioxide is mixed with the combustible nature hydrocarbon refrigerant for increasing the COP. If the carbon dioxide is less than 20 mass %, the quenching (fire extinguishing) effect cannot be effectively given for reducing the combustibility possessed by the combustible nature hydrocarbon refrigerant, such as hydrocarbon, and as a result, it is difficult to assure the safe use thereof. In contrast, as the carbon dioxide exceeds 50 mass %, the ratio of the refrigerant with a COP higher than the carbon dioxide, is low, so that it is impossible to increase the COP of the entire system. Therefore, it is impossible for such a refrigerant mixture composition to be provided for a refrigerating device with a high refrigerating capacity.

[0016] The aforementioned property can be achieved not only by mixing propylene, but also by mixing other nature hydrocarbon refrigerants of various hydrocarbons. According the above property, even though a fixed amount (20 to 50 mass %) of carbon dioxide is mixed with the nature hydrocarbon refrigerant having a COP higher than the carbon dioxide, the COP is not

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reduced. Therefore, by mixing the refrigerant (such as hydrocarbon refrigerant, etc.) in an amount that was previously restricted with carbon dioxide, the refrigerant mixture can be safely applied to a system whose absolute capacity is high and not suitable for refrigerants consisting of only the hydrocarbon refrigerant.

[0018] The nature hydrocarbon refrigerant to be mixed with the carbon dioxide can be non-fluorinated hydrocarbons, such as ethane, propane, propylene, butane, isobutane and pentane, etc., or ammonia, for example. Among which, adding hydrocarbon is preferred. Since these nature hydrocarbon refrigerants have a small warming coefficient, the usage of the nature hydrocarbon refrigerants is very significant in consideration of the earth environment issues. Particularly, the combination of carbon dioxide and the hydrocarbon, it is advantageous in handling the refrigerant mixture because of either nontoxicity or low toxicity. Furthermore, although the hydrocarbon is combustible as describe above, the safety of its use can be increased and improved by mixing with the noncombustible carbon dioxide. The refrigerant (other than the carbon dioxide) to be mixed can comprise at least one kind of various combustible refrigerants (such as artificial refrigerants, etc.) other than the nature refrigerants. However, in view of the environment protection, it is preferable to only add the combustible nature hydrocarbon refrigerant to prepare the refrigerant mixture.

[0023] The refrigerating device of the present invention has the aforementioned refrigerating cycle. Further, since the refrigerating device of the present invention uses the refrigerant mixture

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with a high coefficient of performance, and therefore, a larger refrigerating device can be used. Namely, if a maximum fill amount of the combustible ~~nature~~ hydrocarbon refrigerant in the mixture refrigerant is 150g, a high coefficient of performance of the ~~nature~~ hydrocarbon refrigerant can be maintained, and the safety of the usage thereof can be also achieved. In this case, from the viewpoint of maintaining a high coefficient of performance, a lower limit of the fill amount of the combustible nature refrigerant is preferably at least 50g, and 85g is much better.

Please amend the abstract as follows.

A refrigerating device is provided in which a compressor, a gas cooler, an expansion mechanism and an evaporator are sequentially connected by using refrigerant pipes. The refrigerating device uses a refrigerant mixture in which a combustible ~~nature~~ hydrocarbon refrigerant and a carbon dioxide refrigerant are mixed, and an amount of the carbon dioxide refrigerant in the mixture refrigerant is 20 to 50 mass %. Alternatively, a maximum fill amount of the combustible ~~nature~~ hydrocarbon refrigerant is 150g. Therefore, the refrigerating device has a higher coefficient of performance, a high refrigerating capacity and its safety is higher than that of using only hydrocarbon refrigerant.